Valuing the Benefits of Environmental Protection in Madagascar: Background and Recommendations for the ONE-CFSIGE Case Study Program

April 5, 2000

Task Order No. 829
Contract No. PCE-I-00-96-00002-00

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April 5, 2000

Prepared for:
USAID/Madagascar

Environmental Policy and Institutional Strengthening Indefinite Quantity Contract (EPIQ)
Partners: International Resources Group, Winrock International,
and Harvard Institute for International Development

Subcontractors: PADCO; Management Systems International; and Development Alternatives, Inc.

Collaborating Institutions: Center for Naval Analysis Corporation; Conservation International; KNB Engineering and Applied Sciences, Inc..; Keller-Bliesner Engineering; Resource Management International, Inc.; Tellus Institute; Urban Institute; and World Resources Institute.

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1. Introduction

The National Office for the Environment in Madagascar (ONE), in collaboration with the USAID-funded PAGE Project being implemented by the International Resource Group (IRG), is supporting the development of increased capacity in the monetary valuation of environmental impacts in Madagascar by governmental and non-governmental analysts and other staff. To assist with the development of these activities, the purpose of this report is to assess briefly the current status of such analysis in Madagascar and to provide a set of recommendations for case study topics and supporting training for Malagasy analysts to implement these case studies.

This report is organized into three main sections. Section 2 provides a brief review of the basic issue; namely, what economists are trying to do when they develop monetary equivalents for environmental impacts. Section 3 then provides a review and discussion of the existing literature. Section 4 provides detailed recommendations for case study topics and supporting training activities to implement the program. Section 5 concludes.

2. A Brief Introduction of Monetary Values for Environmental Protection

2.1 What is "Monetary" Valuation Trying to Do?

For basic reasons of economic growth and development of an economy, economic efficiency suggests that natural resources should be allocated to their most "productive," highest "valued" use. To be able to make such resource management decisions, it is important to distinguish between natural resources that are ***natural inventories*** and ***natural assets*** (see, e.g. Toman). For a natural inventory, such as oil in the ground, the value derived from the inventory is from direct extraction and eventual consumption. Thus, one unit extracted today is not available to be extracted tomorrow. On the other hand, just as $100 in a safe bank earning 10% interest provides a sustainable steam of 10$ of income each year, natural assets provide a stream of services overtime depending on the quantity and quality of the asset in place. The distinction between assets and inventories is of fundamental importance for natural resources (land, forests, water, soil, air, etc.) because such resources can often be used in many different, and **incompatible** ways. [1]

A piece of land currently covered with a primary forest provides a classic example of a natural resource that can be used as either an inventory or an asset. As an inventory, the piece of land could be clear cut for commercial timber and then converted to an alternative use. Let Bc represent the total "value" derived from this possible use of the forest. On the other hand, the piece of land could be maintained more or less intact as an asset providing potentially multiple services including: some level of timber- and non-timber products to local communities; regulation of water supplies; a potential location for both domestic and foreign tourists; a repository for biological diversity contained in the forest, etc. Depending on how the asset is managed, many of these services can be utilized simultaneously. In this case, let Bp represent the total "value" from the various compatible uses of the land if it is preserved in forests.

Economic efficiency suggests that this piece of forest land should be allocated to its highest valued use, which for this simple example means clearing if Bc > Bp and preservation if Bp > Bc. The ability to apply this efficiency criteria correctly, of course, assumes that the values from preservation and conversion are identified, estimated, and somehow comparable.

[1] For many standard items in the economy, the distinction between inventories and assets is not that important. A cup of coffee is a cup of coffee, whose value to a consumer is defined in large part by how much she or he likes coffee. Besides consuming the coffee, there are few competing uses for it.

2.2 What Type of Values can be Estimated?

To begin to identify potential values of natural resources, it is now well accepted that natural resources (e.g., the area of land in forests) can provide a combination of use and non-use values to local villagers, other parts of the domestic economy, and to foreigners. For any given resource, four generic sets of values can be defined: **uses values** (now and in the future) from directly using the resource (recreation, hunting, etc.) and indirectly using the resource as an input into some other economic activity (e.g. water and soil in agriculture); **option values** derived from maintaining the resource to retain the right to use it in the future; and **bequest values** are a final form of use value, where in this case a person may place a value on maintaining the resource for future use (e.g. by one's children).[2] It should be emphasized that all these values are associated somehow with either current or potential uses of people in the future. Besides these three categories of use values, existence values (also called intrinsic values) could be based on social, moral, cultural, or religious reasons that are independent of any human use.

While the origin of these values follow from the basic structure of preferences of people, such values defined in general terms (e.g. changes in utility) cannot be directly estimated, aggregated, and compared across people. These "values" have traditionally been translated into monetary equivalents using market information, with the market price of a cup of coffee providing information on your underlying value of the coffee (in non-monetary terms).

Markets have traditionally been the source of monetary equivalents that have guided the use of natural resources and the environment in general. To put it simply, markets and policy makers have traditionally under valued many of the services derived from resource conservation (using the resource as a natural asset) and over valued many of the uses derived by more destructive activities and eventual conversion to other uses (using the resource as a natural inventory). For example, markets have traditionally overvalued more destructive uses of natural resources due to government policies and market failures that allowed certain costs to be excluded from the calculation of Bc. At the same time, since many of the values of using natural resources as assets have not traditionally been easy to observe in markets due to market and government failures (e.g. problems of information, property rights, public good issues, and externalities), markets have traditionally undervalued other uses Bp. This difference between Bc and Bp is also exacerbated in many locations because different groups of people receive the benefits Bc and Bp.

In sum, due to a variety of market and government failures, the values Bp are often considered to be low or not even acknowledged, while of values Bc are easier to observe and often inflated. As a result, the benefits of conservation have been considered low, the benefits of conversion to other uses high, and many economies have a long experience with the conversion of natural areas into other uses, pollution of water and soil, and extinction of species.

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[2] For reference, this option value associated with reserving the ability to use something in the future was originally called quasi-option value by some authors, while option value was originally related to the difference between expected consumer surplus and option price (which had was related to issues of risk aversion). Over time, quasi-option value has been shorten to option value, with the concept focus on retaining the right to use something in the future.

In large part because of these failures of markets to be able to generate appropriate values for many natural resources (both as assets and inventories), the use of indirect and direct methods to derive monetary values of natural resource uses has grown dramatically around the world over the past 40 years to try to "level the playing field" so that the benefits of environmental protection (resource conservation) can be fairly evaluated in relation to other less protective uses. The hope is that by providing better information on the monetary benefits and costs associated from different forms of land use, the monetary valuation of natural resources can "improve decision making and help policy makers strict a balance among economic development, biodiversity, recreation, watershed protection, commodity production, and other objectives" (Jaycox, in Kramer et al.,1995, vi.).

2.3 What Are the Main Methods Used to Estimate Such Values into Monetary Terms?

For reference, these monetary valuation methods can be roughly organized into two main categories. First, related-market approaches attempt to use information from existing markets to estimate the monetary value of various environmental services. These related market approaches include the change in productivity/income approach; the hedonic pricing approach; and the travel-cost approach.[3] And second, the contingent valuation approach attempts to estimate values directly from survey information. There is now a large literature and long experience with using all of these approaches around the world, although the quality of their results varies highly (as with any type of economic analysis).

All approaches to estimate the monetary value of natural resources essentially try to mimic the basic logic of how monetary values are determined in markets. For consumers, value is based on the willingness and ability to pay for the item (e.g. consumer surplus) represented by the area under the demand curve. Any point on the demand curve shows can be defined simply as how much additional welfare the person receives from consuming an extra unit of the item (MUx) divided by how much welfare the person receives from having additional income (MUy). In sum, the willingness to pay for an extra unit of the item x (the marginal willingness to pay—MWTP) is just MWTP = MUx/MUy. For producers, value is usually assumed to be derived from some form of profit changes (producer surplus). The willingness to pay logic extends to the producer side, where producers are willing to pay for something (a resource change) in relation to the associated profit change. Especially in developing countries, these basic notions of willingness to pay can be applied to more complicated situations where households are both producers and consumers.

A few comments are in order here on monetary valuation and willingness to pay. Valuation activities have to start with a clear understanding of 'whose' values are being estimated, and the willingness to pay "for what" have to be clearly specified. For example, regarding the basic "for what" question, asking the 'value' of water is not well define. Asking the value to households of a specific change in water quantity or quality can be well defined.

[3] There are other closely related approaches that are also sometimes used. For example, the replacement cost approach and avoidance expenditures are closely related to the change in productivity/income approach. Issues of human capital and valuation of health risks depend on the results of the other methods (e.g. change in income , hedonic, or contingent valuation).

Once the answers to these two questions are clear, the specified person or groups' willingness to pay will depend on preferences, incomes, technologies, and information. And just to remember, willingness to pay by definition includes ability to pay, since income levels constrain consumer expenditures. In short, market prices and quantities reflect the existing income distribution.

An example may help make this link between value, income, and monetary values more clear. Suppose potable water in a city contains various risks to human health (chemicals, bacteria, etc.). While a wealthy and a poor family may be equally devastated by an acute illness of a child, the willingness to pay of the wealth household to avoid the health risk may be substantially larger simply because of the income difference. Using the notation above, suppose the MUx is exactly the same for the wealthy and the poor household (say -5000 units of lost welfare from a sick child). At the same time, the additional welfare from having an extra dollar is probably small for a wealthy household (say 1) but large for a poor household (say 2500). As a result, the monetary equivalent of the health risk to the wealthy household is -$5000, while the poor household's monetary valuation is only -$2.

Besides income levels, it is also important to remember how values evolve over time as tastes, preferences, information, and technologies change. The gum-resin myrrh, at one time a gift worthy of a king and used in various medical and industrial purposes, is no longer highly valued in markets. The Pacific Yew tree, at one time considered a trash tree whose destruction was subsidized by the U.S. government, became highly valuable for the chemicals in it's bark (e.g. Taxol). Thus, values evolve over time with income, preferences, new information, and technology. The notion of option value introduced above is useful in this context (e.g. in relation to biodiversity conservation. While we know values will evolve in the future, we do not yet know why and how they will change. As a result, there may be a willingness to pay now to maintain something just in case we learn something over time and something becomes more valuable.

And as a final point, the situation in related markets, especially credit markets, has a clear role in influencing market values. In economies with good credit markets, a person with $20,000 in income, little savings, and no other debts can borrow $75,000 against future earnings to purchase certain assets (e.g. a house). However, the same person in an economy with poor credit markets would not be able to borrow and would have to attempt to save money over time to purchase a house. As a result, market demand (i.e. willingness and ability to pay) for the asset is lower in the economy without credit markets.

In sum, willingness to pay to receive some benefit or potential benefit, and willingness to pay to avoid some damage, provides the foundation for developing monetary values for natural resources and the environment.[4] And just as the physical effect to households does not yield equivalent monetary values due to different income levels, etc., physical effects on the production side do not translate into equivalent monetary values for different producers. For

[4] In some situations, it may make reasonable sense to consider willingness to accept levels instead of willingness to pay, with the initial property rights situation providing guidance on which approach to use. For example, if a household already owns the right to use a piece of land for various purposes, it may make more sense to consider their willingness to sell these rights. In such cases, a willingness to pay approach implies the right is going to be taken away unless payment is made.

example, soil erosion provides an easy example of the difference between physical effects and some monetary cost. Consider two plots of land in different locations with different soil depths experiencing the same quantity of erosion per year. On plot A the topsoil depth is high, the farming cycle replaces needed materials adequately with few costs, and the soil erodes onto forested areas lower in the watershed. As a result, the observed physical effect (soil erosion) involves essentially no costs (on farm or off farm). Plot B is just the opposite. Plot B has shallow soils and the farming cycle does not replace needed materials adequately. Moreover, the plot is located near a reservoir used for hydroelectric production. As a result, there are clear costs associated with erosion on plot B including perhaps reduced profits in the future from the agricultural productivity effects of soil erosion as well as impacts on costs of electricity production. Thus, for the same physical effect, say 250 tons of erosion annually, the external cost on plot A is zero and the cost on plot B is not. This example is intended to emphasize that physical effect is not the same as its associated monetary cost.

2.4 How Do These Topics Relate to "Green Accounting" and Sustainability? [5]

It has been long recognized that the basic definition of gross domestic product GDP), defined as final consumption plus gross investment, does not necessarily reflect a sustainable level of income. At the same time, the basic measure of net national product (NNP), defined as GDP minus a capital consumption allowance to account for depreciation of physical capital, does not reflect changes in natural capital (and human capital for that matter). The overall discussion of 'green accounting' includes both of these topics: (1) how to develop a resource consumption allowance to include into the traditional measure of NNP mainly using existing market prices; and (2) how to adjust GDP to account for monetary value of non-market environmental benefits and damages. In general, creating a resource consumption allowance to adjust NNP makes use of Hotelling's Rule and existing market prices. As such, this adjust has little direct relationship to non-market valuation topics.

The second topic, adjusting GDP to account for non-market benefit and damages, in general uses of the results of various non-market valuation studies to attempt to provide a consistent adjustment to GDP to provide a better estimate of full income. Thus, increased capacity in estimating the monetary benefits of environmental production and degradation provides the fundamental information required for such GDP adjustments.

[5] This discussion relies on the overview and survey provided in Vincent and Ali (1997), p. 29-40.

3. Survey of existing studies

This section reviews briefly existing analysis that develops monetary values associated with both the protection and degradation of natural resources and the environment in Madagascar. Over the past 12 years or so, several analyses related to the monetary valuation of natural resource protection and degradation in Madagascar have been completed and published (informally as project documents and formally as articles). This literature also includes at least one reasonable example of the various valuation methodologies. Thus, as a starting point, experience in Madagascar as well as other regions of the world shows that all of the valuation methodologies can in general be appropriately used in Madagascar. The main issue involves choosing the best approach in any given situation depending on the types of values being estimated and the type of data available or possible to develop.[1]

At the same time, except for a recent study by Andriamarozaka et al. (1998), there seems to have been little direct input and report writing in the existing literature by Malagasy economists. In short, there seems to be a general lack of experience with conducting monetary valuation studies and using their results as integral parts of investment and policy decisions. Given the importance for resource management in Madagascar of understanding in monetary terms environmental and natural resource values, building capacity and experience in such monetary valuation remains clearly important.[2]

Having this knowledge is so important in fact, that one might wonder why such capacity building has not been emphasized earlier. For example, following the completion of the World Bank's forestry policy paper in 1992 ("A World Bank Policy Paper: The Forest Sector"), the World Bank's Vice President for Africa Region, Edward Jaycox, summarized the situation well as:

> *."....The lack of knowledge of economic benefits provided by forests, or costs associated with depletion of forests resources and degradation for forest lands, was acknowledged to be handicapping management decision making, project analysis, investment decisions, and environmental assessment."*
>
> *"Thus, based on concerns arising from both environment and forestry, it was recognized that there was a need to increase research on the economic value of tropical forests to help policy makers form wise decisions on the utilization and conservation of tropical forest resources" (Jaycox, 1995, vi.).*

While these comments seem to have been directed toward World Bank related activities, the same can be said of the need to increase capacity in Madagascar to estimate such values,

[1] For example, see Dixon, Scura, Carpenter and Sherman (1994) for several examples of using valuation methods in developing countries. This book also includes a good reference list of other studies and basic methodological guidance.

[2] There is every indication that existing training in microeconomics and statistics is available in Madagascar. Thus, the logical foundations for applied analysis related to non-market valuation, and the ability to learn such topics, already exist to some important degree in the country.

understand what they mean (and do not), and understand how to integrate such information into environmental and economic development policy.

The remainder of this section overviews key existing analysis to date related to the monetary valuation of natural resources in Madagascar. Key documents are discussed first, and then two specific topics (carbon values in relation to climate change policy and biodiversity) are discussed at the end of this section. This review is not intended to be exhaustive, but to illustrate the type of analysis that has been done to date as a foundation for future analyses.

As a starting point, the World Bank's (1996) staff appraisal report for the environmental program provides many good examples of how basic change in productivity calculations can be used to estimate the benefits of environmental protection and the costs of environmental degradation. The basic benefit-cost analysis logic used in these analyses form a core set of techniques and knowledge that should be widely understood in Madagascar by Malagasy governmental and non-governmental analysts. Rather than attempt to provide a complete survey of all the information and analysis in this report, some key information is discussed here that is relevant for developing the ONE-CFSIGE case studies.

For the ONE-CFSIGE case studies, the World Bank (1996) appraisal report suggests on page 8 that the ANAE collected data in the middle 1990s that could be used to evaluate the on-site benefits of adopting more "environmentally friendly" agricultural practices, but concludes that similar data to estimate off-site effects were yet to be developed. Thus, it could be possible for one of the case studies to pursue the use of these ANAE data for various locations to calculate the on-site benefits to farmers of adopting these environmental-friendly technologies. This report also mentions that the EP-2 will implement about 4,000 miniprojects. Thus, the ONE-CFSIGE project may want to investigate these projects and data in more detail to determine what has already been done, what is currently underway, and what would be useful to complete further with the ANAE miniproject data.

Most of the relevant economic analysis for the monetary valuation activities of ONE-CFSIGE are included in Appendix 9 of the staff appraisal report. Annex 9 covers 40 pages singled spaced and provides a wealth of analysis and information that is relevant for the monetary valuation of natural resource protection activities. Since the report is a 'draft' and since it was written with a specific audience it mind, the analysis is probably not that easy to follow for inexperience analysts working on these topics. It is also not clear if this report was translated into French and Malagasy for the local audience of analysts and decision makers. Unless otherwise specified, all page numbers referenced below in relation to this report are from Annex 9.

Page 4–7 of the appraisal report discusses the basic issue of on-site and off-site effects of soil erosion from agricultural land use. The report suggests on page 4 that:

> *"The ANAE experience has shown that simple biological fixation through hedgerows is an adequate investment to move from shifting hillside farming to fixed plots on the central highlands."*

It would probably be useful for PAGE to follow up with the World Bank and ANAE to find the information on which this result is based as a teaching/case study tool for local analysts.

The "value" estimated in this case is the monetary value to farmers of investing a land improvement.

Off-site costs of soil erosion and siltation are also discussed, which can include impacts on water reservoirs and related infrastructure for agriculture and non-agricultural uses, transportation infrastructure, and the productivity of coastal fisheries. For example, Page 5 discusses briefly the benefits and costs of activities designed to renovate irrigation infrastructure investments. In other words, the 'off-site' costs from erosion in the water shed can be estimated in part as the "on-site" costs to irrigation infrastructure and irrigated lands. For investment costs, a number of US$ 4.8 million is provided, although it is not clear how these costs were calculated, at what interest rate, if they are just capital costs or if they include operating and maintenance costs, and the life span of the project. From a cost-benefit analysis perspective, it is also not clear if these are financial costs or 'economic' costs.

On the benefits side, the outcome of this activity is increased agricultural land productivity that would be generated by the project (to avoid the erosion impacts). The specific outcome identified is that 150 hectares of land would be 'saved' each year. In other words, without the project, 150 hectares would be destroyed each year for several years in the future. Thus, production is lost from 150 hectares in the first year, 300 hectares in the second year, 450 hectares in the third years, and so on, for several years in the future. The report concludes that "the annual loss of production is worth $13.8 million."

Unfortunately, not enough information is provided in the report to know how this number was calculated. Based on the information provided on page 5, Table 1 attempts to calculate the present value of the lost production value. For a 30-year project horizon, which is the lowest guess of one of the reservoirs life span with existing erosion levels, with a 10% real discount rate, the present value of production from the 'saved' land equals about $11.9 million.[3] Thus, based on this little calculation, it seems that the $13.8 million reported on page 5 is the present discounted value of all future production, not the annual loss as suggested on page 5. It should be noted, however, that this analysis is contained in a 'draft' appraisal report. The PAGE project may want to follow up to determine if a final report is available.[4]

Of course, this present value of lost output value overstates the net benefits because production costs (including direct labor costs and family opportunity costs) are excluded from the analysis. If production costs were about 50% of revenues, which is probably low, the benefit estimate also falls by about 50%. A time shorter horizon and a higher interest rate would make these benefits look must smaller.

These numbers can also be used to think about the benefits of attempts to reduce soil erosion in the watershed. Based on the appraisal report numbers, the 'renovation' project

[3] For this $11.9 million number, the lost value of production from all 18,000 hectares is included as an additional impact (the time at which the reservoir become useless and the land falls out of production. If it was assumed that these 18,000 hectares were lost forever, and that the project would stop this from happening for about another 50 years (a big assumption), then the present value of the benefits are about $19 million. With a 15% interest rate, even this number falls to just $7.7 million.

[4] For reference Table 2, page 4 (Annex 9) reports rough soil erosion estimates for different land uses. These numbers could be useful for base case calculations of soil erosion damages. Mr. Lambo Rakotovao (1995) is reference as providing the information. Table 3 on page 5 provide guesses of sedimentation rates for irrigation reservoirs in West Madagascar.

provides $13.8 million in benefits for $4.8 million in costs. One could also look at the benefits and costs of erosion control projects in the watershed to determine whether erosion control or mitigation is the better investment strategy (or a combination of both). Other locations identified in the report for such infrastructure problems include Marovoay. The appraisal report (page 6) also references a report AIRD (1990) that "assessed the impact of environmental degradation on irrigation investments in Madagascar," and the same report supposedly shows that "investments in watersheds to avoid degradation are viable, with potential increased benefits to watershed inhabitants from improved productivity on upland crops and from the realization of benefits from forest products." The reference for this AIRD report is not provided in the appraisal report, and ONE-CFSIGE will probably want to find it for future use.[5]

This appraisal report does provides the results of a number of benefit-cost calculations associated with various ANAE-financed activities (see page 23 of Annex 9 and p. 32 of the main report). While the details of the information used to make such calculations are not provided in the appraisal report (and no reference is provided to know from where there are obtained), the report's discussion provides several good examples of how to use the basic logic of benefit-cost analysis to evaluate the benefits of environmental protection activities (and directly or indirectly the costs of environmental degradation).[6]

It is somewhat surprising that the 1996 appraisal report of the monetary impact of tavy production in terms of lost forestry incomes is based exclusively on the 1990 estimates from the EP-I and NEAP. Larson (1994) notes that this figure provided the bulk of the economic costs of environmental degradation discussed in the NEAP and EP-I activities. The Kramer et al. (1995) analysis, which is contained in the Kramer et al. (1995), document will be discussed separately. It is important to note that between about 1990 and this1996 appraisal report, there was **little new information** provided on the economic benefits of biodiversity conservation (and as a result the damages from forest conversion).

On page 11 (of Annex 9), Table 6 suggests possible benefits of ANAE miniprojects, such as improved water control, biological fixation, and potable water supply. This table again seems to suggest that ANAE miniprojects may be a good place to start in developing case studies for the PAGE activities. The benefits side of the activities need to be considered carefully. For example, regarding potable water supply, the main benefit defined was reduction in diarrhea defined as the reduction in medical costs from avoiding diarrhea. As noted in Harrington and Portney (1987), however, it is clear that the reduction in medical expenses is only one of four components of the overall value of health risk reductions. The total value of the risk reduction attributable to better water supply includes: the change in medical costs, the change in avoidance expenditures, the savings in terms of lost income during illness (or taking care of child), as well as the "pain and suffering" effect. Thus, changes in medical costs could vastly underestimate the benefits of the health risk reduction from improved water supply.

Page 24–27 also summarizes some basic analysis of the impacts of woodfuels in Madagascar, based mainly on a simple benefit-cost calculation of the returns to producing

[5] Risks to other infrastructure, such as roads, ports, rail, and hydroelectric dams, is also discussed briefly on page 6.

[6] Pages 9–23 provide some useful information on such analyses.

fuelwood from some existing forest. Seemingly the returns to investing in forestry are high, although the project begins the sawn wood price would only need to fall by 28% for the investment activity to yield negative returns.[7]

Information on improved woodstoves and charcoal systems is provided on page 21 of Annex 9 (from the Isalo Park area).[8] This information is important because it seems to suggest that improved stoves provide clear and substantial benefits to households in terms of time savings and reduced direct wood consumption. Given that indoor air pollution from woodfuels is considered to be one of the most important environmental problems in developing countries, the direct social benefits in terms of reduced indoor air health risks should probably be substantial in Madagascar. A cases study of this topic for the ONE-CFSIGE project would be quite useful.[9]

Of the 40 pages of analysis in Annex 9, about 3 paragraphs on page 27 are devoted to non-timber benefits and 'biodiversity'. Point 78 on page 27 suggests values in the range of $5-$162 per hectare for natural forests, with a value of about $66 noted based on a study by Shyamsundar (1993). ONE-CFSIGE should probably follow up with Shyamsundar directly to have her analysis as one concrete example of doing such productivity calculations.

For biodiversity, point 77 provides some information on existing export values of natural products (e.g. Rosy Periwinkle, Prunus africanum bark, etc.). This paragraph also notes that basic export information on such products is lacking, while no estimates of an average value per hectare of biodiversity are available. [10]

As a final point, we turn to tourism revenues and park fees. These calculations are based on numbers and fees are the tourist expenditures (e.g., $25 per tourist per park), but not quite the tourist monetary values. Since tourist values (i.e. consumer surplus) from site visits could be substantially larger than existing payments, it is possible that park related expenditures are a poor estimate of a park's total value. At the same time, given all the other costs associated with traveling to and in Madagascar, it is entirely possible that tourist's values are already being acquired elsewhere in the economy away from the park. Besides these review calculations for ANGAP funding issues, the appraisal report does not attempt to provide information on values to tourists of their tourism activities.

While the World Bank (1996) appraisal report provides a good starting point for using basic benefit-cost calculations and productivity changes to value environmental protection

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[7] The numbers in Table 15 are somewhat difficult to understand. With 180,000 hectares managed in year 1, and an average yield of 8.4 m3/H of sawn wood, the sawn wood volume in year one should be about 1.5 million m3 of sawn wood. However, the table in page 26 reports 37.8 million m3 (it actually reports 37,800 million, it is a guess that this means 37.8 with the comma replacing a period). On page 24 of Annex 9, a 1994 study of the environmental impacts of woodfuels in Madagascar is mentioned. The PAGE project should attempt to find this report.

[8] It is possible that this information could be useful for a case study related to the health impacts of indoor air pollution from existing fuel use and the health benefits of using improved stoves.

[9] It is also note here that the economic analysis annex related to the USAID-KEPEM project also contains some useful examples of how to use basic production information to make environmental damage estimates. These calculations follow the basic logic of a change in productivity approach.

[10] Related to biodiversity, references to studies by McManus (1995) and Vallade (1995) are made on page 27 of Annex 9, but little information is provided.

activities, the Kramer, Sharma, and Munasinghe (1995) analysis provides examples of several valuation methodologies and results of their application in Madagascar. This report should be a basic reference for most people working on such topics in Madagascar, and ONE-CFSIGE should follow up with the author's to determine if the report is available in French and Malagasy, and if it has been widely distributed to analysts in the country. It seems likely that the project could acquire directly from the authors some of the basic data sets to facilitate training on using these issues in Madagascar.

While Part A of the Kramer et al. (1995) report provides a nice introduction to the basic issues around forestry benefits in tropical countries, Part B provides four chapters related to explicitly valuation analyses in Madagascar. Chapter 4 by Shyamsundar, Kramer, and Sharma looks the impacts on local villages from the creation of protected area (in this case the Mantadia National Park). Thus, for the valuation issue, this analysis focused on the local level costs of reducing local access to the land now in the park. Based on the use of two different methodological approaches (the change in income approach and contingent valuation), this approach suggested that local households lost the equivalent of about $91–$108 per year. Most importantly, the two approaches yielded very similar result. The potential benefits from the creation of the park to local villagers were not assessed in this chapter.[11]

Chapter 5 by Mercer, Kramer, and Sharma focuses on the benefits to foreign tourists from international tourism as well as visiting a specific site in Madagascar (the Perinet Special Reserve). The recreation demand analysis used in this chapter is based on both travel cost approaches and contingent valuation. Again, the results across the different methods are within a reasonable range, from a low of $24-$65 per tourist per trip to a protected area. When aggregated across the expected number of tourists, with 10% discounted for 20 years, the foreign tourist benefits were estimated in a range between $0.90-$2.5 million.

Chapter 6 provides on example of estimating the off-site damages from soil erosion (flooding and damage to irrigated rice areas), which can then be translated into the potential benefits of erosion control that are provided by keeping land in forests. In the study area, flooding occurs generally after key harvests, so that the damage from flooding due to destroying certain land areas is considered. Thus, the damage calculated is the lost land value associated with different flooding scenarios depending. The net benefits, in terms of flooding damage avoided by keeping the land in forests was estimated at about $71,000 in present value terms.

Andriamarozaka, Andrianarison and Bailly (1998) provide one example of how to use the hedonic approach to value environmental resources through impacts on housing values.[12] For this analysis, coastal erosion and flooding is the key issue. For this study, a hedonic approach is used to estimate the relationship between housing values and distance to the shore (controlling for other factors that affect housing values). In other words, all else constant, the fall in housing

[11] A later report by Shyamsundar and Kramer (1996) provides more detailed information on the contingent valuation strategy used for this analysis, documents the direct valuation question used, and provides revised numbers on the results (a mean of $50 per household for losing access to the park land).

[12] For the PAGE activities, it could be useful to create a small methodology case study for the hedonic approach using this study. One could essentially just write a small description of the methodology and then show how to use it empirically with the data set already collected. This report would then provide one could methodological reference for Malagasy economists to use in the future.

values associated with being closer to flood prone areas can be interpreted as the economic costs of coastal erosion and flooding.

A recent report by Obled and Rajaonson (1998) also discusses a variety of issues related to conservation and development activities in Bemaraha, and pages 50-70 outline the characteristics of various production systems in the region. This report remains conceptual at a general level and is more-or-less consistent with the change in productivity approach to environmental valuation. The concepts are not applied and no empirical results are provided.

3.1 Carbon and Climate Change: The Potentially New Valuable Service

Regarding forest protection in general, there is growing awareness that developing countries may be able to benefit directly in international climate change policies by preventing deforestation (a carbon emission reduction that may be valuable) and growing new forests (carbon sequestration that also may be valuable). A soon to be published article suggests that the carbon values in Madagascar associated with maintaining land in a park (and forested) are fairly enormous compared to compared to other benefits (e.g. non-timber forest products, community forestry, watershed protection, etc..). Thus, the topic of climate change and international agreements such as the Kyoto Protocol are twisting the economics of tropical forest protection in a potentially new and interesting way. The global benefits from tropical forest protection may turn out to be rather large, and the key question will be if the developing countries themselves will be able to extract some of these values through emission trading, joint implementation and clean-development mechanism activities.

As a rough guess, current estimates are that carbon could trade in the range of $50 per ton in the first budget period (years 2008-2012), which could be discounted back for forwards trades to perhaps $25 per ton now. If there were 100 m3/hectare of biomass per hectare in a forested area (a number used in the EP-I analyses), and as an example if there are 0.65 tons carbon per m3 biomass, each hectare could be providing 65 tons of carbon in reduced emissions each year. As a starting point, this forest hectare is producing 65*25 = $1600 annual emission gross benefits (say to polluters in another country). As a starting point, this number shows that the benefits are potentially quite large. There are several related details for such analyses, such as deforestation probabilities that would also need to be considered. But from Madagascar's perspective, it would seem very important to be involved in climate change policy discussions so that the final outcomes create possibilities for this potential benefit to be captured by Madagascar.[13]

[13] There is a large existing literature on such carbon values and related issues. See, for example, Golub (1999) and references contained therein.

3.2 What about "biodiversity"?

In many respects, one could consider all of the returns provided by maintaining more-or-less intact 'natural' areas as the returns to biodiversity. Some of these returns exist now in terms of non-timber forest products used and marketed at the local level (e.g. as discussed above in the Kramer et al. analysis). Some of these returns exist now in terms of exports of rosy periwinkle, reptiles, butterflies, birds, various plants for ornamental and medical purposes, etc. It is also well recognized that some of these returns are through 'legal' exports and 'illegal' exports. For example, the World Bank (1996) report reported export figures at about $2.5 million 1995, which perhaps could have grown to $3 million by 1999. If illegal and, as a result, undocumented exports are important, the total amount of exports (legal and illegal) could be in the range of $6-12 million (depending on the ratio of legal to total exports). With a 10% real interest rate, the present value today of maintain these sources of exports (and the habitat in which they are found) could easily be between $60-120 million. Given the basic growth in such markets and the likely future growth in various food products and dietary supplements that are not considered "drugs" by, for example, the U.S. Food and Drug Administration, it is likely that this initial estimate is too small. With a 5% growth in annual exports, these present value numbers grow easily grow to $120–240 million. A more careful look at such export revenues as part of the biodiversity puzzle is probably warranted by the ONE-CFSIGE activities.

Besides these existing and easy to discuss commercial values collected and harvested from natural areas on the country, the more complicated component with biodiversity involves option, bequest, and intrinsic values (see section 2 of this report for a brief description of these values). Regarding option values, there is the well documented fact that natural habitats contain a wealth of species and their genes, some of which are documented but many of which are currently unknown. If these habitats are maintained over time, there remains the possibility that new information will become available (either by luck or systematic research) that may prove highly valuable in the future. As Reid (1993) summarizes, this topic has been argued for decades, with the importance of the gene pool contained in natural habitats to provide useful information and materials for new foods, medicines, and industrial products. The numbers are relatively staggering at face value. For example, Reid (1993) reports that the market value in 1985 of drugs (over the counter and prescription) accounting for around $43 billion in sales in mainly OECD countries. With these annual figures, the present values of such sales could easily be $430 billion with just current levels of sales.

The importance of genes from wild plants species for agricultural and food products is also well documented, and the likely growth in such activities as biotechnology also genetic materials to be used in new ways or developed more quickly than using past research technologies.[14]

[14] While I do not have numbers at the moment, it is clear that the growth in "dietary" supplements using plant based materials has grown dramatically over the past years in Europe, the U.S. and elsewhere. It seems these products attempt to remain outside the complicated drug review and approval process, thereby drastically reducing time to market and development costs.

Of course, such market revenues have little direct relevance for the protecting of natural areas that potential contain important sources of genetic materials. In some ways, this biodiversity potential is somewhat like buying a lottery ticket. Suppose tickets are sold for $1, which provides a 1 in 10,000,000 chance at winning $10 million. This lottery is 'fair' because, before the fact, the expected value of winnings is simply $1. In many respects, the information on existing market profits (not simply sales) of drug, food, and industrial products, provide some useful information on the potential size of the lottery winnings.

The literature on biodiversity prospecting, the studies by Simpson, Sedjo, and Reid (1996) and Rausser and Small (2000) provide information on the potential size of this option value to research companies to attempt to discover valuable products in natural ecosystems.[15] While largely following the same logic, the key difference between the two studies is initial information. Simpson, Sedjo and Reid (1996) assume prospecting is a simple lottery, with each test essentially providing equal probability of success (a chance of 1.2 success in 100,000 tests). Rausser and Small (2000) assume that researchers have prior information so that they are able to preform tests on the highest probability samples first, thereby increasing the change of success earlier in the research process. Using similar starting assumptions for their numerical **examples**, it is emphasized here these are just numerical examples, these two studies suggest that commercial companies would be willing to pay a maximum of between $6 to $3000 per hectare to maintain a natural area for it's potential future biodiversity commercial values. These numbers are not intended to be taken too seriously, but they do provide useful strategies for beginning to think about the maximum that a risk-neutral, well-financed company might be willing to pay in a one-time cash payment for the right maintain access to a natural area. Using the high number of $3000, these one time payments would translate into a $300 annual equivalent payment (using the 10% interest rate used in the referenced studies), with the lower number the annual equivalent payment is essentially zero.

These studies provide useful, but fairly complicated frameworks for beginning to think about the maximum companies might be willing to pay for bioprospecting rights. While these are the maximum, there is also additional issues related to risk aversion, research budget constraints, and payment vehicles between the companies and the countries. All of these factors probably act to limit the final payment that could be expected in the future. At the same time, it is clear that new technologies (biotech), changes in consumer preferences in international markets, and knowledge about natural areas are growing fairly quickly over time.

And as a final point, 'eco-labels' are now widely discussed in developed and developing countries as a tool of environmental policy.[16] At a basic level, ecolabels are an attempt to product differentiate in some market, with the hope that consumers are willing to pay more per unit for the differentiated product. Correlated with such issues, there is also a clear focus on education and marketing (and various advertising campaigns) as means to create awareness of the issue among consumers, as a way for shifting consumer preferences and, therefore, willingness to pay.

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[15] For an introduction to this literature, see for example Reid (1993) and Sedjo (1992). Also see Simpson, Sedjo, and Reid (1996) and Rausser and Small (2000) for detailed economic analyses related to attempts at calculated option values for bioprospecting.

[16] A useful reference is Zarrilli, S., Jha, V. and R. Vossenaar (1997), although work on this topic has expanded quite quickly over the past few years related to child labor, sweatshop labor, song-bird coffee, etc.

It is likely that such topics are already discussed regularly in Madagascar. While it is likely that eco-labels will continue to be more common in the future, it seems far to early to tell how various products and sectors of the economy (e.g. coffee) could potentially be involved in such activities.

4. Recommendations for a Program of Training and Pilot Studies

4.1 Introductory Comments

Given that there is already adequate basic training in microeconomics available in Madagascar, a program that combines targeted training and information on valuation methods along with hands-on experience with the application of various methodologies is an obvious way to build practical capacity in the monetary values of environmental protection and degradation in Madagascar. Most of Section 4 will focus on recommendations for the pilot studies, with the final portion outlining a training agenda to support the pilot study teams.

As a general starting point, for pilot studies to be successful and to provide a clear blueprint for future applications in the country, the pilot studies needs to define a topic as clearly as possible for the analysis. In short, each pilot study needs to identify as clearly as possible the "commodity" that is being valued. By placing the pilot study topic into the context of something detailed and clearly identified at the beginning, the program can greatly increase the probability of success for the individual studies and the set of studies as a whole. Poorly defining the environmental change (the 'commodity') remains one of the biggest problems with completing reasonable non-market valuation studies.

To help define pilot study topics, it seems best to try to place each case study within some project context, either an existing explicitly defined "project" or a potential project designed to generate some outcome. In this case, one of the outcomes of the project is an environmental impact (good or bad), which can be converted into a monetary equivalent. Existing projects completed or under consideration in the country provide natural possibilities (ANAE and ANGAP miniprojects, etc.). If there are EIAs in progress or about to begin, a pilot study could follow directly from one of the EIA activities.

And as a final introductory comment, it is necessary from the beginning to define clearly whose values are being estimated (a farmer, a village, the country, local tourists, foreign tourists, the world, etc.). For any pilot study, it is not necessary to try to estimate all the benefits/costs of some environmental impact.

4.2 Important Subject Areas

Regarding specific topics, it is recommended that the pilot studies cover a range of environmental protection topics of current and likely future interest in Madagascar. Based on a series of meetings and discussions held in Antananarivo during 14-23 March 2000, an example list of topics is provided in Table 1. This list is intended to provide a reference to the wide range of topics that could be the focus of specific pilot studies. These topics could be defined in a variety of ways. For example, some of the 'benefits of protected forests' could also be called the 'off-site costs of soil erosion', where such erosion was related to deforesting the forested land.

4.3 Criteria for Selecting Pilot Study Topics

To initiate this capacity-building program, it is recommended that the following key criteria are used to assist with the selection of the pilot studies:

- ***Feasibility***

For a pilot study, it is recommended that the complete level of effort is about 4 person months (i.e. about 60 days of effort), with the pilot study beginning in May 2000 and being completing finished with a final report by January 15, 2001. As a result, a clearly defined topic that can be completed within this level of effort and time line is needed.

- ***Policy Relevance and Direct "Client" or "Champion" Interest***

While a main goal of this program is to build capacity in natural resource and environmental economics in general and valuation methods in particular, it is recommended that most of the case studies be focused on topics that are directly related to the activities and needs to various government and perhaps non-governmental agencies. This direct relevance can help to ensure assistance with data access or development while increasing the capacity of the pilot study teams to explain the direct relevance of the pilot study results. At the same time, it is likely that this interaction with such clients will increase the understanding of these topics and methods within the government. In short, direct relevance of the pilot studies can help to ensure future demand for such analyses in the country to supporting environmental policy decision making.

- ***Wide Coverage of Natural Resource and Environmental Problems***

Given the diversity of environmental and natural resource management topics in Madagascar, the pilot studies should included a wide range of topics that include the major resources and problems in the country (as noted in Table 1).

- ***Complete Range of Environmental Valuation Methods***

To build capacity for the future, it is recommended that the set of pilot studies include a wide range of valuation methods. While each pilot study will probably focus on one main methodological approach, the set of pilot studies should include good examples of all the basic valuation approaches.

- ***Good Example for Future Replication***

So that the pilot studies provide a good foundation for future applications, one key purpose of the pilot studies should be to provide a useful guide for replication and extension to other topics in the future.

There is of course some natural tension among these various criteria. A topic that is policy relevant may not provide the best example of analysis that can be replicated for other topics in the future. Fortunately, if 10-15 pilot studies are identified for the program, some of the topics can rate more highly on some of the criteria but lower on other. Thus, in the end, it is likely that the 10-15 case studies could include 3-4 topics for each methodology, with at least one case study for methodological clarity and the other chosen for direct policy relevance.

Regarding 'whose' values are being estimated, it would make sense to have perhaps 4 or more study focus on values to local residents directly affected on resource use, about 2-4 studies that focus on regional/national benefits, and 1-2 studies focus on foreign/international benefits.

4.4 Recommended Roles of the Program Advisory Group and the Pilot Study Leaders

To implement the program, an advisory committee in Antananarivo can provide methodological assistance and quality control related to the pilot study analyses and the writing of the final reports. While each pilot study report should include an executive summary, the advisory council be responsible for writing perhaps 3-5 "policy briefs"(about 2 pages in length) that highlight key results and implications of the various case studies. It is likely that each policy brief will contain information based on more than one pilot study.

The importance of the quality control function of the advisory council should not be underestimated. If at least some of the case studies are designed to be useful to others in the future as guidance on how to conduct such analyses, the quality and clarity of the final output probability needs to be of much higher quality than is commonly the case for project outputs written by Malagasy economists (and foreign consultants for that matter) in Madagascar. This has been my standard experience from working on case studies in at least 10 countries, including the U.S.

The Pilot Study Leader is the economist responsible completing the complete pilot study at an acceptable level of quality and on schedule. Because these pilot studies are essentially economic analyses, it makes clear sense for the Pilot Study Leader to be trained as an economist. The Advisory Committee, and myself, will provide technical assistance to this person regarding methodology, etc., but the Pilot Study Leader is the principal investigator for each individual study.

Depending on the topic, the Pilot Study Leader will probably need to identify other specialists to be integrated into some of the analysis at various stages. These other team members could be economists, survey specialists, data analysts, agronomists, etc. For each study, the relevant need for other specialists to be involved in the study should arise fairly clearly. As in any research activity, it is not necessary that all members of the team participate in all portions of the analysis. The size of the team and logical make up will depend on the specific case study topic as well as overall level of effort (about 4 months) available for the analysis.

4.5 Training to Support Completion of the Pilot Studies

It is likely that targeted training should be provided to the Pilot Study Leaders to facilitate a wider understanding of monetary valuation theory and methods. While the training should be targeted to the Pilot Study Leaders, other interested individuals in universities, the government, and consulting groups could also be invited to attend. As an initial recommendation, which should be revised after the Pilot Study Leaders are identified and their existing skills are assessed, I recommend a simple three stage training program:

Stage 1: review key welfare concepts that are the foundations for monetary valuation (demand, supply, producer surplus, consumer surplus, how to estimate welfare changes using some simple elasticity projections, externalities, market failure, property rights, etc..) (about 4-8 hours)

Stage 2: present an overview of key valuation concepts and then explain each methodology (change in productivity approach, hedonic approach, travel cost approach/recreation demands, contingent valuation) generally and with some practical detail (about 12 hours total)

Stage 3: using actual data sets, have the students work through an empirical case study to understand more of the empirical details needed for the different methods and how to interpret the results (about 4 hours per empirical case study, for a total of 16 hours).

If this training program covered about 32-36 hours of time in total, the program could be offered either consecutively over one week or offered one day per week (e.g. a Saturday) over several consecutive weeks. Given the likely schedules of the Pilot Study Leaders and the Advisory Committee, the second option probably is the best choice. Members of the Advisory Committee should be the main lecturers for the training program.

As reference documents for such training, it makes sense to have a select set of reference documents, including a core text and/or materials related to cost-benefit analysis as well as each valuation method. Such materials should be in French.[17]

[17] For reference, I delivered a large number of relevant materials on benefit-cost analysis, including lecture notes for a basic benefit-cost analysis course, and non-market valuation to the PAGE office in Antananarivo during March 2000. The Harberger and Jenkins benefit-cost analysis manual is probably the state-of-the art, while a lower level text and/or materials is probably needed for the training activities.

5. Conclusion

Decisions almost always involve trade offs. Such trade offs can be inferred after-the-fact by knowing which option was chosen (or allowed to happen), and such trade offs can be evaluated before-the-fact in an attempt to inform better the decision making process. Environmental impact assessment in general, and the monetary valuation of environmental services and impacts in particular, are systematic attempts to make explicit these trade offs.

It is clear from the discussion provided in this report that there is an existing stock of analyses completed in Madagascar concerning the monetary valuation of natural resources and the environment.[18] There are reasonable enough examples of all the basic valuation methodologies that can provide useful guidance and information for future activities. At the same time, the existing analyses are relatively limited in scope, and there is little direct experience with Malagasy analysts defining and completing such analyses. Developing such domestic capacity seems critical in creating increased local knowledge of the benefits and costs of existing patterns of resource use, and the potential benefits to altered (and perhaps better) patterns of resource use.

[18] The studies discussed in this report were provided in part by the PAGE team. It is not yet know if these studies cover all the existing relevant literature, and it is expected that additional useful documents will continue to be discovered, acquired, and retained by the PAGE project.

References and Tables

Andriamarozaka, I., Andrianarison, F.J. and D. Bailly, "Case Study of Madagascar: Economic Evaluation of Coastal Erosion in Morondava" (in French), prepared for a regional training program, Seychelles 14018 December, 1998.[19]

Dixon, J.A., Scura, L.F., Carpenter, R.A. and P.B. Sherman (1994), "Economic Analysis of Environmental Impacts" New Edition, London, Earthscan Publications, Ltd.

Golub, A., "Russian Forests for Climate Change Mitigation: An Economic Analysis," Harvard University, Bullard Fellowship Report, 1999.

Kramer, R. A., Sharma, N. and M. Munasinghe, "Valuing Tropical Forests: Methodology and Case Study of Madagascar," World Bank Environmental Paper Number 13, 1995.

Obled, S. and H. Rajaonson, "Etude des systemes de production Tsingy du Bemaraha," Centre d'Etudes et de Recherche pour la Gestion des Ressources Renouvelables (CERG2R), June, 1998.

Harrington, W. and P. Portney, "Valuing the Benefits of Health and Safety Regulation, J. of Urban Economics, 22(1987): 101-112.

Rausser, G.C. and A.A. Small, "Valuing Research Leads: Bioprospecting and the Conservation of Genetic Resources," Journal of Political Economy, 108(2000): 173-206.

Reid, W., "The Economic Realities of Biodiveristy," Issues in Science and Technology, 10(1993-1994): 48-55.

Sedjo, R.A., "Property Rights, Genetic Resources, and Biotechnological Change," Journal of Law and Economics," 35 (1992): 199-213.

Simpson, R.D., "The Economic Valuation of Biodiversity in Sri Lanka," A Report Submitted to NAREPP, June, 1996.

Simpson, R.D., Sedjo, R.A., and J.W. Reid, "Valuing Biodiversity for Use in Pharmaceutical Research," Journal of Political Economy 104(1996): 163-185.

USAID, KEPEM Project, Economic Analysis, Annex X.

Vincent, J.R., Ali, R.M., and Associates, Environment and Development in a Resource-Rich Economy: Malaysia under the New Economic Policy, Harvard Institute for International Development, Harvard University, Cambridge, MA, USA, 1997.

[19] Note that the other case studies completed for this Seychelles meeting (availabe in the IRG office) also provide some interesting analyses of environmental benefits and costs that could also be directly relevant to Madagascar.

World Bank, Staff Appraisal Report, Madagascar Second Enviroment Program, September 6, 1996, Environment Group, Africa Region, Draft, "Confidential," Report No. 15952 MAG.

Zarrilli, S., Jha, V. and R. Vossenaary, Eco-Labeling and International Trade, London: MacMillan Press (published for and on behalf of the United Nations), 1997.

Table 1. Pilot Study General Themes and Example Topics

Estimate the On-Site Benefits of Existing Land Uses:

benefits to local villages in terms of 'minor' forest products (foods, building materials, herbs and medicinal products, etc.)

the on-site productivity costs of soil degradation, or the on-site benefits of various activities to reduce soil erosion

forestry commercial benefits to a village associated with managing a natural forest for sustainable timber production

Estimate the Off-Site Damages of Soil Erosion from Agricultural and Forestry Activities:

productivity effects on downstream activities (irrigated agriculture, transport infrastructure, tourism, aquaculture, ports, etc.)

effects on downstream water supplies (e.g., the possibility of Amber Mountain and Diego town's water supply)

Estimate tourism values for specific sites:

estimate tourism values for a local park used by Malagasy residents

estimate tourism values for a national park Malagasy residents and foreigners

use the results of the above analysis to inform investment decisions and fee structures at the site

Estimate Malagasy household values for improved public services:

better water supply is the obvious topic, although other services such as solid waste collection could be considered

Estimate the costs of existing health risks from:

wood fuels and indoor air pollution

outdoor urban air pollution (e.g., traffic)

existing water sources

Annex A

Information Sheets for 10 Proposed Case Studies

Case Study 1 – On-Site Costs of Soil Erosion

General Policy Context

Agricultural development remains a key to the social and economic development of Madagascar. Lost productivity of agricultural lands from soil erosion and degradation has been identified as a potentially important issue, and a number of ANAE and ANGAP mini-projects have focused on increased the farm-level returns to investments in soil conservation.

General Valuation Topic

This Case Study fits within the general topic of valuing the on-site productivity effects of land degradation and/or valuing the on-site benefits of efforts to reduce such degradation.

Specific Valuation Topic

A specific minproject site related to ANAE, ANGAP, and/or an ICDP should be chosen to be the focus of this analysis.

Method Likely To Be Used

The change in income/productivity approach will probably be the best choice for this Case Study, although it could be possible to use hedonic price and contingent valuation approaches depending on the location and details of the situation.

Relevance of Study for Practical Decision-Making

The economic value of agricultural projects is typically measured by the value of produce grown on the land. Yet it has become clear that the lost of soil to farmers via erosion is another important source of agricultural benefits and costs. Clearly, some technologies are more conducive to loss of soil cover (e.g., tavy rice) than others. Designing programs that reduce soil erosion are predicated upon farmers having sufficient incentive to do so. This study will generate specific estimates of the costs to farmers of losing soil to select agricultural practices. Results from the study can be used to design interventions with a greater likelihood of success. The results might also be used to quantify the benefits of select ANGAP-funded mini-projects and ANAE, as part of a process of assessing whether their benefits justify their costs.

Potential Clients

ANAE, Ministry of Agriculture or ANGAP.

Reference in Literature If Relevant

Magrath and Arens, World Bank, Environment Department Working Paper No. 18 (1989)

Lutz, Pagiola, and Reiche, The World Bank Research Observer (1994)

Level of Effort for Case Study

Equivalent of 4 person months (88 days)

Time Schedule for Case Study

Training and Topic Definition:	May–July
Data Collection:	July–September
Data Analysis and Draft Report:	October–November
Revision and Final Report:	December–January

Case Study 2 – Value of Non-Timber Forest Products

General Policy Context

Natural forests often provide substantial amounts of valuable, non-timber products to local communities. Such values have often been not recognized or ignored when consider land use policies (such as establishing forestry concessions as well as protected areas) in many parts of the world.

General Valuation Topic

This Case Study fits within the general topic of valuing the on-site productivity effects of natural forest protection to local communities.

Specific Valuation Topic

Choose a specific study area within which to estimate the market value equivalent of forest products to households in villages with access to natural forests (either in FMG or some other unit such as units of rice).

Method Likely To Be Used

The change in income/productivity approach will probably be the best choice for this Case Study.

Relevance of Study for Practical Decision-Making

NTFPs provide a source of potential revenue from forests. Community-based forest management presumes that communities benefit from having greater control over the total revenue stream from forests. This study would help understand just how much value communities can or might obtain from NTFPs in forest resources. Such information is an essential prerequisite to design of sustainable community-based forestry initiatives, and more generally to identifying incentive levels for sustainable exploitation. It could also be used to develop special economic management terms to encourage benefit sharing.

Potential Clients

Ministere des Eaux et Forets; plusieurs ONG; ANGAP.

Reference in Literature If Relevant

Pinedo-Vasquez, Zarin, and Jipp, Ecological Economics (1992)

Shyamsundar, Kramer and Sharma, in Valuing Tropical Forests, edited by Kramer, Sharma, and Munasinghe, World Bank Environment Paper 13 (1995)

Level of Effort for Case Study

Equivalent of 4 person months (88 days)

Time Schedule for Case Study

Training and Topic Definition:	May–July
Data Collection:	July–September
Data Analysis and Draft Report:	October–November
Revision and Final Report:	December–January

Case Study 3 – Profitability of Following EIA Recommendations

General Policy Context

While EIAs are often considered to be part of the project planning and implementation cycle, it is safe to say that many private sector groups consider such activities as a 'cost' of doing business. Documenting the beneficial impacts of EIAs through increased profitability should increase acceptance of such requirements within the private sector.

General Valuation Topic

This Case Study fits within the general topic of valuing the on-site productivity effects of completing an EIA and following its recommendations regarding production activities.

Specific Valuation Topic

A specific private sector aquaculture operation has been identified as the likely candidate for this Case Study.

Method Likely To Be Used

The change in income/productivity approach will probably be the best choice for this Case Study.

Relevance of Study for Practical Decision-Making

Those institutions responsible for implementation of the MECIE Decret are constantly faced by the complaint from investors that conducting an EIA results in a loss of money for them. Representatives of the Government have attempted to make the case to investors that conducting an EIA is not just a legal requirement, it may also be a means to improving the profitability of their operations. The objective of this study is to look closely at the relative costs and benefits in a "with" and "without" EIA scenario for an actual investment that took place in the country. Understanding how conduct of an EIA might contribute to private sector profitability would assist Government officials in raising levels of compliance with the MECIE.

Potential Clients

ONE, and especially its Cellule MECIE; Ministry of the Environment; Cellules Environnementales with increasing responsibilities for implementing the MECIE Decret.

Reference in Literature If Relevant

No specific references at this time. This Case Study can be organized as a simple exercise in cost benefit analysis of the EIA recommendations. Special consideration should be noted in this Case Study that the value of shrimp products in Madagascar is probably too low relative to some efficient outcome if over harvesting and environmental damage exists in the sector.

Level of Effort for Case Study

Equivalent of 4 person months (88 days)

Time Schedule for Case Study

Training and Topic Definition:	May–July
Data Collection:	July–September
Data Analysis and Draft Report:	October–November
Revision and Final Report:	December–January

Case Study 4 – Carbon Sequestration and Deforestation

General Policy Context

Standing natural forests, and slowing deforestation of such areas, provide a variety of valuable services to economies including water management, biodiversity, non-timber forest benefits, etc. Such forests are also natural carbon sinks when growing and sources of carbon emissions when burned and/or harvested. While this function of a forest has created little direct economic value to a country in the past, evolving policies related to green-house gases and climate change are beginning to make the sink and emission reduction functions of forests potentially valuable through existing and possible future mechanisms (e.g., JI, AJI, CDM, and emissions trading).

General Valuation Topic

This Case Study fits within the general topic of valuing the on-site productivity effects of protecting a natural forest area.

Specific Valuation Topic

An existing study for the Masoala Peninsula exists and can provide the starting point of this Case Study.

Method Likely To Be Used

The change in income/productivity approach, which focuses on the correct accounting for carbon sinks and/or emissions avoided, is the best choice for this Case Study.

Relevance of Study for Practical Decision-Making

The market for carbon offsets, in which companies or governments outside Madagascar pay Madagascar to conserve forests, is an important potential future funding source for the country. Before Madagascar can begin to enter into any sort of negotiations concerning how much their forests are "worth" as carbon offsets, however, it needs to have a concrete idea of the economic value of these forests, in particular with respect to their rate of absorption of carbon. This study would deepen the knowledge of methods for calculating such estimates, and would thus feed directly into process of future negotiations on the issue.

Potential Clients

Ministere de l'Environnement; Ministere des Eaux et Forets; Ministere des Finances

Reference in Literature If Relevant

Masoala study, and background papers by Golub.

Level of Effort for Case Study

Equivalent of 4 person months (88 days)

Time Schedule for Case Study

Training and Topic Definition:	May–July
Data Collection:	July–September
Data Analysis and Draft Report:	October–November
Revision and Final Report:	December–January

Case Study 5 – Discovery Values and Biodiversity in Natural Areas

General Policy Context

It is well recognized that diverse ecosystems may contain useful and potentially valuable materials. In general, private sectors companies may be willing to pay for the right to search in these diverse ecosystem for such materials. As a result, these "bioprospecting" or discovery values are another source of value created by natural areas in Madagascar. The potential magnitude of such bioprospecting values, and well as the country's ability to acquire such values, have not be adequately evaluated.

General Valuation Topic

This Case Study fits within the general topic of valuing the on-site effects of protecting a natural forest area.

Specific Valuation Topic

This topic focuses on estimating "biodiversity' values at two levels: direct profits from existing natural products (i.e., for medical and research purposes as well as exports for fauna and flora); and discovery values (also called quasi-option values) associated with the rights to search in an area for valuable materials.

Method Likely To Be Used

For existing production and exports of plants and animals, simple revenue and profit calculations can be made. For the discovery values, either contingent valuation or the methods outlined in Simpson, Sedjo, and Reid (and Rausser and Small) can be considered.

Relevance of Study for Practical Decision-Making

Costa Rica receives an annual payment each year of over $1 million from a pharmaceutical company that is eager to take advantage of the genetic material existing in the country's biodiversity. Might Madagascar be able to broker a similar deal? Might the revenue generating potential of the genetic value of Madagascar's biodiversity justify further exploration of programmatic options to take advantage of it? This study should deepen the understanding of what options might be explored by Madagascar.

Potential Clients

Ministere de l'Environnement; ONE's Biodiversity Unit; MEF; Conservation International; WWF.

Reference in Literature If Relevant

Sedjo, Journal of Law and Economics (1992)

Simpson, Sedjo, and Reid, Journal of Political Economy (1996)

Rausser and Small, Journal of Political Economy (2000)

Level of Effort for Case Study

Equivalent of 4 person months (88 days)

Time Schedule for Case Study

Training and Topic Definition:	May–July
Data Collection:	July–September
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Case Study 6 – Off-Site Costs of Land Clearing on Irrigation Infrastructure

General Policy Context

Agricultural growth possibilities can be damaged due to siltation of irrigated lands following deforestation and land clearing in the watershed.

General Valuation Topic

This Case Study fits within the general topic of valuing the off-site costs of land degradation through valuing the on-site losses occurring elsewhere in the watershed.

Specific Valuation Topic

A specific site should be chosen, and it is probably easiest to consider the benefits of some project designed to renovate an irrigation area. An AIRD (1990) report "assessed the impact of environmental degradation on irrigation investments in Madagascar" and showed that "investments in watersheds to avoid degradation are viable, with potential increased benefits to watershed inhabitants from improved productivity on upland crops and from the realization of benefits from forest products." This report should be as a starting point for additional analysis.

Method Likely To Be Used

The change in productivity method is probably most useful.

Relevance of Study for Practical Decision-Making

Initial evidence from the FCE railroad region after the two cyclones is that extensive damage was done to irrigation infrastructure. The costs of restoring those irrigation systems to a functional state will certainly be high. This study intends to estimate the cost of off-site erosion from land clearing on downstream irrigation infrastructure. Might the costs of restoring irrigation infrastructure be so high that it would make economic sense to finance conservation and land protection upstream out of saved revenues from downstream protection? The study should help shed light on such possible approaches.

Potential Clients

MEF; ANAE; Ministere de l'Environnement

Reference in Literature If Relevant

World Bank, Staff Appraisal Report (1996)

Magrath and Arens, World Bank, Environment Department Working Paper No. 18 (1989)

Level of Effort for Case Study

Equivalent of 4 person months (88 days)

Time Schedule for Case Study

Training and Topic Definition:	May–July
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Case Study 7 – The Value of Urban Water Supplies

General Policy Context

Land use changes in watersheds can affect water supplies in urban centers. The value of improved urban water supplies can be used to estimate the off-site costs to urban centers of land uses in a watershed. Such values can also be used in financing strategies for such public service improvements.

General Valuation Topic

This Case Study fits generally within the topic of valuing the consumptive use of an environmental resource, in this case water, to urban residents.

Specific Valuation Topic

A possible topic is water scarcity in the city of Diego, which is potentially related to land use changes in the Amber Mountain Area. Other sites at which such a study might be undertaken include Ft. Dauphin and Fianarantsoa, both of which are facing water supply problems linked to loss of forest cover.

Method Likely To Be Used

Contingent valuation is probably a good method to use for this Case Study, although it is possible that changes in direct water expenditures and/or averting measures could be combined with the contingent valuation analysis.

Relevance of Study for Practical Decision-Making

Urban managers (and especially mayors) may be faced with the likelihood that they will not be able to supply water for their cities in the coming years. They are often aware that forest loss contributes to declining water availability. At some point, they will need to ask the hard financial question: Would it cost less in the long run to find a way to stop forest loss in the watershed or to invest in a new water supply system for the city? This study can provide them with a useful point of reference for making such a decision and for developing a cost recovery strategy.

Potential Clients

The mayors of Diego, Ft. Dauphin, Fianarantsoa, as well as members of MEF, Ministere des Eaux et Forets.

Reference in Literature If Relevant

See the numerous studies by D. Whittington.

Level of Effort for Case Study

Equivalent of 4 person months (88 days)

Time Schedule for Case Study

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Case Study 8 – Tourism, Parks, and Regional Economic Development

General Policy Context

It is hoped that tourism can provide an economic development benefits to Madagascar in a way that is consistent with the protection of specific sites and parks. A better understanding of tourist values of visiting specific sites (both at the site and in the region) can help to identify the total value of protecting various sites in the country as well as improving fee-setting strategies for park management and local communities.

General Valuation Topic

This Case Study fits generally within the topic of valuing the non-consumptive uses (i.e. tourism) of an environmental resource, in this case a specific site.

Specific Valuation Topic

A specific site should be identified that is visited by foreign and local tourists.

Method Likely To Be Used

Contingent valuation is probably a good method to use for this Case Study, although travel cost approaches could be considered as well. The focus would be on tourist values while visiting the site. At the same time, regional expenditures by tourists on other items could be identified as well as one indication of the level of regional economic impacts from tourism.

Relevance of Study for Practical Decision-Making

It requires an investment on the part of the Government to keep Parks functioning, but these Parks in turn generate revenues for the country, at both a national and regional level. If the Government knew how much the park system contributed to regional development by drawing in tourists, it would help to make a viable case for further investing in the park system. This study is designed to develop specific estimates of how much tourists spend in the region when they visit a park.

Tourist's "willingness to pay" to visit a park is often higher than the entry fees at the park entrance. If they have spent thousands of dollars and come from thousands of miles away, they may not hesitate to spend a few more dollars to get into a park. A second objective of this study is to estimate tourists' "willingness to pay" to get into one national park. Such information could be used (as it has been in many countries) to modify park entrance fees in accordance with willingness to pay.

Potential Clients

ANGAP; Ministere de Tourisme.

Reference in Literature If Relevant

Mercer, Kramer, and Sharma (Section 5), in the edited volume by Kramer, Sharma, and Munasinghe (1995)

Level of Effort for Case Study

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Time Schedule for Case Study

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Case Study 9 – Value of Improved Water Supplies in Rural Villages

General Policy Context

Generating local benefits from protected area management through revenue sharing and community investments is considered to be a key to increased support at the local level for conservation activities.

General Valuation Topic

This Case Study fits within the general topic of valuing the benefits of improved public services.

Specific Valuation Topic

A specific location should be determined when mini-project activities have included water supply activities. The value to these local residents from improved water supplies can be estimated.

Method Likely To Be Used

Contingent valuation is the most likely method although a travel-cost approach could also be considered if the water supply investment altered the water supply location or fetching time.

Relevance of Study for Practical Decision-Making

When environmental and social benefits are taken into account, it may be that water supply improvement projects in rural villages are one of the most effective means of increasing support for conservation activities. With detailed estimates of the economic benefits and costs of such projects, they could be compared to other local economic project activities (see other Case Studies) so as to determine the most cost effective approaches for combining rural development and conservation. Such information is important for allocating water supply according to willingness to pay of the households. The information would also be helpful in developing strategies for cost recovery.

Potential Clients

ANGAP; Ministry of Health.

Reference in Literature If Relevant

See the numerous papers by D. Whittington

Level of Effort for Case Study

Equivalent of 4 person months (88 days)

Time Schedule for Case Study

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Case Study 10 – Health Risk from Indoor Air Pollution and Wood Fuels

General Policy Context

Indoor air pollution is considered to be one of the top environmental problems in the developing world, leading to increased mortality risks for adults and children and additional cases of acute respiratory illness especially in children.

General Valuation Topic

This Case Study fits within the general topic of valuing the benefits from reduced health risks.

Specific Valuation Topic

A specific site or sites should be chosen where villages use traditional cooking methods and if possible where some improved stove system has already been introduced in the community.

Method Likely To Be Used

Contingent valuation can possibly be used as well as direct health risk calculations.

Relevance of Study for Practical Decision-Making

How do the costs of rural indoor air pollution—especially from wood fuels—compare with those of urban health expenditures on respiratory illness? How do the costs compare to other major illnesses. Might there be low cost means to address these respiratory problems that are entirely justified in light of the costs? This study should generate information helpful in developing or refining health expenditure strategies.

Potential Clients

Ministry of Health, Ministere de l'Environnement.

Reference in Literature If Relevant

See various papers by Kirk Smith as well as forthcoming background papers for the WHO/USAID consultation on indoor air pollution to be held in Washington, DC during early May 2000.

Level of Effort for Case Study

Equivalent of 4 person months (88 days)

Time Schedule for Case Study

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